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Characterization of Oxacillinase and Metallo-β-Lactamas Genes and Molecular Typing of Clinical Isolates of *Acinetobacter baumannii* in Ahvaz, South-West of Iran

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Abstract

Background: Carbapenem resistant *Acinetobacter baumannii* is an important nosocomial pathogen associated with a variety of infections.
Objectives: The current study aimed to characterize the antimicrobial susceptibility, analyze the prevalence of oxacillinase and metallo-β-lactamase (MBL) genes and molecular typing of clinical isolates of *A. baumannii*.
Materials and Methods: A total of 124 non-repetitive isolates of *A. baumannii* were collected from various clinical specimens in two teaching hospitals in Ahvaz, south-west of Iran. Antimicrobial susceptibility test was carried out by disk diffusion method. The minimum inhibitory concentrations (MICs) of imipenem, meropenem, colistin and tigecycline were determined using E-test. To screen for MBL production, double disk synergy (DDs) test and MBL E-test were performed. The presence of $bla_{\text{OXA-23-like}}$, $bla_{\text{OXA-24-like}}$, $bla_{\text{OXA-51-like}}$, $bla_{\text{OXA-58-like}}$, bla_{VIM}, bla_{IMP} and bla_{SPM} genes was assessed by polymerase chain reaction (PCR). To identify clonal relatedness, all isolates were subjected to repetitive sequence-based PCR (rep-PCR)
Results: Based on disk diffusion results, the highest rate of resistance was observed in rifampin (96.8%). Colistin and polymyxin-B were the most effective agents in vitro. According to the MIC results, the rate of resistance to imipenem, meropenem, colistin and tigecycline were 78.2%, 73.4%, 0.8% and 0, respectively. Metallo-β-lactamase production was positive in 42.3% and 79.4% of the isolates by DDs test and E-test, respectively. All isolates (100%) carried $bla_{\text{OXA-51-like}}$ gene. According to the results of multiplex PCR, $bla_{\text{OXA-23-like}}$ and $bla_{\text{OXA-24-like}}$ genes were detected in 85.6% and 6.2% of carbapenem resistant isolates, respectively. No $bla_{\text{OXA-58- like}}$, bla_{VIM}, bla_{IMP} and bla_{SPM} were detected. By rep-PCR, carbapenem resistant isolates were separated into six genotypes (A to F). Genotype A (30.9%) was the most prevalent (P value < 0.001). Genotypes B and C were found in 28.9% and 26.8% of the isolates, respectively.
Conclusions: The rate of carbapenem resistant *A. baumannii* isolates were high in this study. Since, $bla_{\text{OXA-58-like}}$ or MBL genes were not detected, it seems that resistance to carbapenems is related to $bla_{\text{OXA-23-like}}$ and $bla_{\text{OXA-24-like}}$. Moreover, $bla_{\text{OXA-23-like}}$ was the most prevalent oxacillinase (OXA) gene. Most of the isolates belonged to one of the four dominant genotypes indicating clonal dissemination in the hospitals under study. In order to control the spread of carbapenem-resistant *A. baumannii*, infection- control strategies are needed.

Keywords: Acinetobacter baumannii, Carbapenems, Oxacillinase, Typing

1. Background

In recent years, *Acinetobacter baumannii* has emerged as an important pathogen in nosocomial infections and especially infects critically ill patients admitted to the intensive care units (ICUs) (1, 2). Septicemia, pneumonia, urinary tract infection, wound infection and meningitis are among the infections caused by this pathogen (3). In the hospital environment, resistance of *A. baumannii* to antimicrobial agents raises concerns (4). Carbapenem resistant *A. baumannii* are great concerns for physicians because carbapenems are common choice to treat infections caused by this pathogen (4, 5). In addition, therapeutic efficacy of carbapenems is limited due to spread of carbapenem resistant *A. baumannii* (4, 6). Carbapenem resistance is now observed worldwide in *A. baumannii* and these isolates are usually resistant to all classes of antimicrobial agents. A plenty of outbreak due to carbapenem resistant *A. baumannii* are reported from different countries and this situation had a worrying trend (4).

Carbapenem resistance in *A. baumannii* is mediated by combined different mechanisms including: reduced per-

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